Blueberries

IN THE HOME GARDEN

John C. Cain
and G. L. Slate

CORNELL EXTENSION BULLETIN 900
NEW YORK STATE COLLEGE OF AGRICULTURE

Blueberries in the Home Garden

By JOHN C. CAIN AND G. L. SLATE

The growing of improved high-bush blueberries is a relatively new horticultural industry that is expanding rapidly in a few counties in New Jersey, Michigan, and North Carolina, and to a limited extent in other areas where soil and climatic conditions are suitable. Commercial production of improved varieties began about 1916 and there are now about 8,000 acres under cultivation in the United States. Blueberry growing in New York is limited to a few plantings on Long Island and occasional small plantings elsewhere.

The first systematic attempts to improve the wild high-bush blueberry were begun in 1906 by the United States Department of Agriculture under the supervision of the late Dr. F. V. Coville whose work on soil requirements, breeding, and variety selection was largely responsible for the development of the cultivated blueberry industry. The blueberry is the most recent fruit plant taken from the wild and placed under intensive commercial production. Although only about 45 years from the wild state, the most recently introduced cultivated varieties are as different from their wild parents as modern hybrid corn is from its parents the Indians were growing when the white man discovered America.

Distribution and Climatic Requirements

Many species of wild blueberries are naturally distributed throughout the United States. They are usually found wherever there is an adequate year-round moisture supply and acid-soil conditions. Even the mountain blueberries, frequently seen thriving in seemingly droughty situations, usually receive a continuous supply of moisture by lateral seepage along the surface of the bed rock on which the layer of soil and leaf mold is perched.

The cultivated blueberry industry is founded on varieties developed by selection and breeding from the northern high-bush blueberry *(Vaccinium corymbosum)*. This species is found naturally under a rather wide range of climatic conditions. Successful plantings of the improved varieties exist from Maine to southern Georgia and from the warm humid summers of New Jersey to the cool dry summers of the Puget Sound region of Washington. Irrigation alone has tremendously increased the acreage on which blueberries can be grown successfully.

The blueberry is a deciduous shrub with a winter cold-period requirement similar to that of the peach. A minimum of 650 to 850 hours (accumulated) below 40°F. are required for satisfactory resumption of growth in the spring. It is probably hardier than the peach, frequently surviving temperatures as low as 25° to 30°F. below zero when satisfactorily hardened off in the fall.

Temperatures lower than 20° to 25°F. below zero may be expected to winterkill some of the canes, but the extent of winter injury varies with the condition of the wood. Very vigorous plants that make late growth may be injured more than plants making normal growth which is checked in midsummer.

Some varieties are hardier than others. In 1948 near Geneva, following a minimum winter temperature of 31°F. below zero, many canes of the Dixi variety were killed to the ground or died soon after leafing out. Jersey produced an above medium crop, Rubel a below medium crop, and the other varieties light to very light crops. The canes of Pemberton, Atlantic, and Jersey were apparently uninjured. Injury to Rancocas, Concord, and Pioneer was shown by some dead canes, and reddish foliage on the others indicated partial injury.

When the tops are killed by low winter temperatures, the crown and roots are usually protected by the snow cover and put out new shoots which frequently bear the following year. Where deep snow prevails, most of the bush may be protected from extremely low temperature.

Late-growing shoots are sometimes killed back from the tip by early fall frosts, but usually this is not a serious problem. Late spring frosts sometimes injure partly opened flowers which results in a partial to a total loss of crop on some of the early blooming varieties. Usually these varieties are not planted in areas subject to late spring frosts.

Blueberry flowers are more frost-resistant in bloom than are those of other fruit plants. Observations in Michigan indicate that blueberry flowers in full bloom were not injured by 23°F., but 21°F. reduced the yield of Rubel 12 percent and of Cabot 50 percent. In a wild blueberry swamp half the crop was destroyed by a temperature of 19°F.

In the Experiment Station's planting at Geneva a temperature of 20°F. on May 11, 1949, reduced the crop to a few berries per plant on most varieties, but Jersey and Rubel produced fair crops.

The high-bush blueberry ripens from 60 to 90 days after bloom, depending on the variety and the average temperature during the growing season. The plants should have from 40 to 50 days between harvest and the first killing frost to mature new wood and form fruit buds for the next year's crop. Thus areas with less than 100 to 110 days between killing frosts are probably not suitable for the growth of the present cultivated varieties. Some wild species survive, however, in areas with shorter growing season.

Soil Requirements

Soil structure

The blueberry root has no root hairs as do many other plants, but the entire root system is very fine, fibrous, and hair-like in structure. These fine roots cannot push their way into a compact heavy soil. The soil must be open and porous in structure, providing numerous minute passageways for the easy movement of roots. Sandy soils, peats, and loam soils very high in organic matter are best.

Soil moisture

Probably for the same reason (the fine fibrous nature of the roots) blueberries cannot withstand drought. The soil must provide a moist root environment throughout the growing season. If this is not provided by natural soil water, supplemental irrigation or a mulch must be used.

Natural blueberry soils frequently have a water table about 12 to 18 inches below the surface which is rather constant throughout the season. On some sandy soils if this water table is lowered as much as a few inches, young plantings may die for lack of water. Many commercial growers are finding that irrigation

is profitable even under the best of soil conditions. On the other hand, plants are easily killed by being flooded or submerged during the active growing season. Thus areas subject to standing water after heavy summer rains must be adequately drained.

Organic matter

Usually soil organic matter is important for the improvement of soil structure and for the retention of moisture and nutrients. Under natural conditions plant residues, such as sawdust, peat, leaf mold, and the like, are the most economical materials to use because they are readily available and can be easily incorporated into the soil. These and other materials, such as wood chips, hay, and straw, may be added as a mulch on the surface of the soil after the plants are established to supply additional organic matter, retain soil moisture, and help control grass and weeds.

In addition, organic matter in the soil helps to prevent the loss of plant nutrients by leaching and through both chemical and biological fixation. Minerals such as potash, magnesium, and calcium are retained by the exchange complex, and nitrogen and phosphorus are converted to organic form by microorganisms and are later released for plant use. Nitrogen may also be held to a considerable extent in the ammonium form which is readily absorbed by blueberry roots. Organic matter seemingly aids in the maintenance of available forms of certain minor elements, such as iron, which is essential for good growth.

Soil acidity

An acid soil is usually considered a necessity for good blueberry growth. A soil pH of 4.0 to 5.2 is usually best for the prevention of iron chlorosis (yellowing of the leaves) and the maintenance of nitrogen in the ammonia form. Soils can usually be tested for acidity by the local county agricultural agent.

Under acid soil conditions (below pH 5.5) with a good supply of organic matter, nitrates are converted to ammonia nitrogen by soil organisms and utilized by the blueberry plant. As the soil becomes less acid, nitrifying organisms become more active in the soil and ammonia nitrogen is converted to nitrates which are less easily utilized by blueberry plants and are more readily leached out of the soil. Thus, proper soil acidity is important for the maintenance of the proper forms of both iron and nitrogen for the blueberry plant.

Blueberry plants have remained vigorous and healthy under artificial conditions at the New York State Agricultural Experiment Station at Geneva at a soil pH of 6.5 by the frequent application, or continuous supply, of iron and nitrogen in the proper form, that is, ferrous iron and ammonium nitrogen. The leaves of the plants become yellow and growth stops within two to three weeks when these nutrients are not supplied. Under natural field conditions the continuous supply of proper nutrients is most economically assured by maintaining proper soil acidity and moisture conditions.

Soil modification

Ideal soil conditions for the growth of any plant are seldom found in nature in the most desirable geographical locations. This is especially true of blueberries. Usually some modification from the natural conditions must be made to improve the chances of a successful planting in the home garden.

Soil structure is most easily improved by the incorporation of organic materials, such as sawdust, peat, muck, wood chips, or leaf mold, into the soil. Heavy soils require larger quantities than do light soils and are more difficult to maintain. Lighter soils are easier modified and easier maintained in the desired condition.

Soil acidity may be modified for blueberry culture within restricted limits. The acidity of light sandy soils is most easily affected by applications of sulfur, aluminum sulfate, or acid peat. Moderately light loam soils may be acidified if not too far from the desired acidity. Heavy clay soils, especially if they have a reaction above pH 6.0, usually cannot be permanently acidified for blueberry culture without a great deal of expense and effort.

Sulfur is the most economical acidifying agent. This should be thoroughly worked into the soil to a depth of six inches in the spring to allow plenty of time for soil bacteria to oxidize the sulfur. Sulfur, except in very light applications, injures the plants if applied directly to the roots.

One pound of sulfur per 100 square feet of soil changes the pH of a light sandy soil from 5.5 to 4.5 when completely oxidized by soil bacteria. A heavier loam requires from three to four pounds to produce the same degree of acidification. It is usually not advisable to try to correct the acidity of heavy soil if the pH is greater than 5.5 to 6.0.

The most satisfactory method of soil modification for blueberries in the home garden is to use sawdust or peat. Probably the surest method of growing a satisfactory blueberry bush is to mix equal volumes of soil and loose peat in the planting location and then mulch the plant with from three to six inches of sawdust.

Location

Frequently the home gardener has little or no choice of soil in which to plant his blueberries. If, however, there is a choice, the site should be one that stays rather wet all summer but is not submerged during the growing season. Light sandy soils are superior to clay but are sometimes more difficult to keep at the proper moisture content. The location should be open, have free access to sunlight, and be far enough from trees and shrubs to prevent competition for available water. The area should be kept completely free of grass and weeds at least three feet from the plants.

The site has much to do with the success of the planting. Under certain conditions, it can affect temperatures greatly during the winter or during the blooming period in the spring. Low areas surrounded by higher land from which the cold air may descend on still, frosty nights are especially subject to frosts. In these frost pockets the minimum temperature on a still night may be several degrees lower than on higher land nearby. Areas completely surrounded by trees and brush which reduce air circulation are also subject to more severe frosts than are open sites. Winter temperatures are lower where air drainage is poor.

Mummy berry, a fungus disease that attacks the berries and causes them to dry up and drop off at harvest time, is much more serious in situations where air circulation is poor. Poor air circulation prevents the berries from drying quickly after a rain, and the prolonged wetting favors the growth of the mummy berry fungus.

Good air circulation is therefore a highly desirable characteristic of a site for a blueberry planting. Sloping land or a level area not surrounded by higher land or trees and shrubs should provide good air circulation.

Varieties

Blueberries in New York State are often incorrectly called huckleberries. The huckleberry belongs to the genus *Gaylussacia* and can be distinguished from the blueberry by its ten comparatively large seeds, each of which is surrounded by a bony covering like a minute peach pit which crackles between the teeth. The blueberry belongs to the genus *Vaccinium* and has from 50 to 75 small seeds which are not noticeable when the berry is eaten. The undersides of huckleberry leaves are sprinkled with resinous dots which are absent on blueberry foliage. Huckleberries are inferior in quality to blueberries but are occasionally used. There are many species of blueberries, but nearly all of the improved cultivated varieties that are now being planted extensively are derived from the high-bush blueberry *(Vaccinium corymbosum)*.

The cultivated blueberry industry is founded on varieties developed by the late Dr. F. V. Coville of the United States Department of Agriculture in cooperation with Miss Elizabeth White of Whitesbog, New Jersey. From 1909, when the first crosses were made between selected wild types, until 1952, 98,000 hybrid seedlings have been fruited and 24 varieties named. In addition to these hybrid varieties, Rubel, a selection from the wild, is still grown extensively.

Older varieties

The older varieties described in the following paragraphs have been grown for many years and their merits and faults are well known. Many of them are still sold generally by nurseries, but they are much inferior to the more recently

Figure 1. Fruit of Rubel blueberries infected with "mummyberry" fungus. The infected berries shrivel and turn cream colored at ripening time. Uninfected berries in the same cluster ripen normally.

developed varieties and many should no longer be planted. Superseded varieties for commercial planting are June, Cabot, Rancocas, Concord, Stanley, Pioneer, Dixi, Rubel, and Burlington. Jersey is one of the best of the older varieties, and Atlantic and Pemberton are also excellent. The poor scar of Pemberton limits its planting to home gardens or for nearby markets as it does not keep well.

Of the older varieties, Stanley and Dixi are superior in quality, and Jersey and Atlantic are of good quality when fully ripe. The smaller berries of Rubel are better for blueberry muffins than the very large berries of the most recent introductions. Weymouth is useful only for its earliness and will undoubtedly be replaced by Earliblue when that variety has been more thoroughly tested and is generally available from nurseries.

Jersey and Rubel are the hardiest of the older varieties and have fruited well following low winter temperatures and spring frosts that eliminated most of the crop of other varieties.

Atlantic. Bush very vigorous, open spreading, hardy, and very productive. Berry large, oblate, five-sided, light blue, firm, somewhat acid until fully ripe, good, late. Scar small, not tearing. Atlantic is one of the best varieties for market and home use, because of its outstanding vigor and productiveness of plant and its size, color, and firmness of berry.

Burlington. Bush moderately vigorous, upright spreading, hardy, and moderately productive. Fruit cluster medium compact. Berry medium size, light blue, firm, good, latest. Scar not tearing. Burlington is the last to ripen, but the slow growth of the plants has resulted in lower yields than with the more vigorous varieties.

Cabot. Bush below medium in vigor, low, spreading, moderately hardy, and moderately productive. Fruit cluster medium compact. Berry below medium size,

Figure 2. Clusters of the variety Rubel—the only variety originally selected from the wild that is still in extensive commercial production. The berries are smaller than those of most of the other varieties but the bushes are very productive.

roundish oblate, dark blue, medium firm, mild subacid, fair quality, early. Scar small, not tearing. Cabot was once the standard early variety, but many other varieties are superior and its planting is no longer recommended. The plants and flowers are less hardy than those of other varieties.

Concord. Bush vigorous, upright spreading, hardy, and productive. Fruit cluster compact. Berry medium size, oblate, light blue, firm, subacid, good, late midseason. Scar medium size, tearing easily. Concord is a fine quality variety for home use, but it has been superseded by others for market purposes.

Dixi. Bush vigorous, open spreading, usually hardy, moderately productive. Fruit cluster medium loose. Berry very large, oblate, five-sided, medium blue, firm, subacid, good, late. Scar large, not tearing. Dixi is the largest of all varieties with the possible exception of the recently introduced Coville and Berkeley. The quality is better than average, but the bush is less productive and in a severe winter is less hardy than other sorts. It is well worth growing in the home garden but of doubtful value commercially.

Jersey. Bush very vigorous, upright, hardy, and very productive. Fruit cluster very loose. Berry large, roundish oblate, uniform in size, light blue, firm, acid until fully ripe, good, late. Scar large, not tearing. Jersey is one of the best varieties for market and home use. The vigorous, heavy-yielding bush is one of the hardiest and has fruited well at Geneva after minimum winter temperatures that destroyed the crop and injured the wood on other varieties except Rubel. Jersey also produced a fair crop following a temperature of 20°F. on May 11, 1949, which destroyed the crop on other varieties except Rubel. Loose clusters facilitate harvesting. The berries color well before they are fully ripe, but picking should be delayed until they are much sweeter.

June. Bush of below medium vigor, upright, moderately productive. Fruit cluster very short. Berry of medium size, roundish oblate, dark blue, firm, fair quality, very early, and all ripening quickly. Scar tears somewhat. June is of value only for its earliness. The leaves are susceptible to a leaf spot that causes many to drop prematurely and reduce plant vigor.

Pemberton. Bush very vigorous, upright, hardy, and very productive. Fruit cluster loose. Berry very large, oblate, medium blue, or darker than Jersey, firm, mild, subacid, good, late. Scar large, tearing easily. Unusual vigor of plant brings this variety into heavy bearing a year or two earlier than most other sorts and results in a larger plant. The tearing of the scar may be serious in wet weather and materially reduces the keeping quality of the berries. Pemberton is one of the better varieties for home use and local markets because of plant vigor and berry size.

Pioneer. Bush of medium vigor, low, spreading, hardy and productive. Fruit cluster medium compact. Berry medium size, oblate, dark blue, medium firm, mild, good, midseason. Scar small, not tearing. Pioneer, the first variety to be named from the breeding work of the United States Department of Agriculture, has long been a standard midseason variety, but the new sorts are superior in every respect.

Rancocas. Bush of medium vigor, upright, hardy, and productive. Fruit cluster compact. Berry of medium size, oblate, medium blue, firm, subacid, good, early midseason. Scar medium size, may tear badly under certain weather conditions. After a heavy rain on August 2, 1946, which followed a drought, the scars tore easily and all of the berries cracked. Rancocas is inferior to several of the newer varieties in most respects.

Rubel. Bush vigorous, upright, hardier than most varieties, and productive. Fruit cluster loose. Berry medium size or below, oblate, light blue, firm, subacid, fair to good quality, late. Scar medium size, not tearing. Rubel is the only wild selection that is extensively grown. It became and remained a leading variety because of its vigor, hardiness, and productiveness. In fruit characters it is inferior in size and quality to most of the recent varieties.

Stanley. Bush vigorous, upright, hardy, and moderately productive. Fruit cluster medium compact. Berry large at start of season, but becoming too small at later pickings, oblate, light blue, firm, sweet, very good to best, midseason. The high quality of Stanley makes it a favorite for the home garden, but the small size of the berries after the first pickings is a serious fault.

Weymouth. Bush of medium vigor, spreading, moderately productive. Fruit cluster medium loose. Berry above medium size, roundish oblate, dark blue, firm, poor quality, earliest of all. Weymouth is of value only for its earliness. The dark color and poor quality are serious faults.

Newer varieties

The following varieties are new sorts recently introduced from the breeding work of the United States Department of Agriculture. They originated in New Jersey where they have been well tested on a few farms. Berkeley, Bluecrop, Coville, Earliblue, and Ivanhoe bore their first crop at Geneva in 1954, and here, as well as in New Jersey where they have been seen by the writers, they appear to be promising enough to replace the older varieties. The fruit characters are excellent, but it will take several years to determine productiveness, resistance to low winter temperatures, spring frosts, and other plant characteristics.

The plant descriptions that follow are mostly adapted from the originator's description.

Berkeley. Bush very vigorous, open spreading, and productive. Fruit cluster large, medium loose. Berry largest of all, oblate, light blue, firm, mild subacid, good, ripening with Stanley. Scar small, tears occasionally. In view of its promise in New Jersey, Berkeley should be tried by growers interested in better varieties.

Bluecrop. Bush vigorous, upright, and productive to the point of overbearing, requiring more severe pruning to restrict the crop. Fruit cluster large, medium loose. Berry large, roundish oblate, very light blue, very firm, subacid, good, midseason, or a few days later than Stanley. Scar small. Bluecrop merits trial because of its unusual productiveness, its attractive color, firmness, high quality, and good scar.

Coville. Bush vigorous to very vigorous, open-spreading, and productive. Fruit cluster large, medium loose, berry very large equalling Berkeley and Dixi in size, oblate, light blue, firm, subacid when fully ripe, very late, from 10 to 14 days later than Jersey. Promising at Geneva because of its very vigorous, productive bush and large firm berry that hangs on the plant in good condition until early September. The flavor is very acid.

Earliblue. Bush vigorous, upright, and productive. Fruit cluster medium size and medium loose. Berry large, oblate, light blue, very firm, subacid, good, ripening very early, or with Weymouth. Scar average. Earliblue is described as superior to the very early variety Weymouth in vigor of bush, size, color, firmness, and quality of fruit. It should be tried by all who want an extra early variety to replace Weymouth.

Table 1. Varieties of high-bush blueberry ranked for some principal characteristic*

Season (*early to late*)	**Berry Size** (*large to small*)	**Berry Color** (*light to dark*)	**Dessert Quality** (*good to poor*)	**Bush Shape** (*erect to spreading*)
Weymouth	Berkeley	Berkeley	Dixi	Rubel
Earliblue	Coville	Bluecrop	Ivanhoe	Rancocas
June	Herbert	Earliblue	Herbert	June
Cabot	Dixi	Stanley	Stanley	Pemberton
Rancocas	Ivanhoe	Ivanhoe	Earliblue	Earliblue
Ivanhoe	Atlantic	Jersey	Pioneer	Stanley
Stanley	Pemberton	Atlantic	Bluecrop	Coville
Concord	Earliblue	Concord	Coville	Ivanhoe
Bluecrop	Bluecrop	Burlington	Atlantic	Jersey
Pioneer	Weymouth	Rubel	Concord	Bluecrop
Berkeley	Jersey	Cabot	Berkeley	Berkeley
Atlantic	Concord	Coville	Pemberton	Herbert
Pemberton	Stanley	Rancocas	Burlington	Concord
Rubel	Burlington	Herbert	Jersey	Burlington
Herbert	Pioneer	Dixi	Rancocas	Dixi
Jersey	June	Pemberton	June	Atlantic
Dixi	Rancocas	Pioneer	Rubel	Weymouth
Burlington	Rubel	June	Cabot	Pioneer
Coville	Cabot	Weymouth	Weymouth	Cabot

*Compiled from United States Dept. Agr. Farmers' Bul. 1951 and New Jersey Agr. Exp. Sta. Bul. 767.

Herbert. Bush vigorous, upright-spreading, and productive. Fruit cluster large and loose. Berry one of the largest, oblate, medium blue, firm, subacid, one of the best in quality, late. Scar fair. Herbert is worthy of trial as a late variety, being one of the best in size, firmness, quality, and productiveness of bush.

Ivanhoe. Bush vigorous, large, upright, and productive. Fruit cluster medium size and medium compact. Berry very large, roundish oblate, light blue, firm, subacid, very good, early midseason. Scar very good. Ivanhoe is promising at Geneva for its large size, good scar, high quality, and vigorous bush.

In table 1 varieties are ranked in the approximate order for some of their principal characteristics.

Propagation

Blueberry plants are usually grown from hardwood cuttings started in the spring in specially designed frames or propagating beds. The cuttings root with difficulty, and considerable skill and experience are required to propagate the plants profitably. The small-scale planter will find it more satisfactory to buy plants directly from a nursery that specializes in propagating blueberry plants. For larger plantings it may be advisable to use rooted cuttings and give them nursery care the first year.

Pollination

Most blueberries will produce good crops when planted in solid blocks of one variety. It has been shown in pollination experiments at several experiment stations, however, that pollination by another variety results in larger berries, a higher proportion of the flowers setting fruit, and earlier ripening of cross-pollinated as compared with self-pollinated berries. A row of one variety to two or three of another is enough for cross pollination. Much of the pollination is done by bumble bees which are very numerous in a blueberry field during the blooming period.

Selecting Plants

Planting stock should be purchased from growers specializing in the propagation of improved named varieties. The blueberry specialist is much more apt to have the newer and better varieties. Many of the older and inferior varieties are still being sold and occasionally blueberry plants are offered without indicating the variety. The planter should order varieties by name.

Plants offered by the nursery are usually one or two years old. The one-year-old plants are rooted cuttings direct from the propagating bed or tray. Two-year-old plants are rooted cuttings that have been grown for a year in the nursery. The better size for most purposes is a large two-year-old plant. Rooted cuttings, or one-year-old plants, are less expensive and may be used if one is prepared to give them nursery care with watering if the weather is dry.

Planting

If the soil is to be modified as described (page 4), this is best done in early spring preceding fall planting or spring planting the following year.

The plants should be set as early in the spring as the soil can be worked without packing it. Fall planting is satisfactory with two-year-old or older plants if the soil is mounded up around the plants to a depth of several inches or if a heavy sawdust mulch is used to prevent them from being heaved out of the soil by alternate freezing and thawing during winter.

The area should be staked out so that the plants will be at least four feet apart in the row and the rows far enough apart to permit easy access during cultivation and harvesting operations. The minimum row distance for hand operation is six feet and at least eight feet if a garden tractor is to be used between the rows. If the area between the rows can be completely covered with sawdust, there should be little or no need for cultivation as the weeds and grass can be easily removed by hand or by the use of fuel-oil spray. Commercial plantings are usually spaced five feet apart in the row with rows ten feet apart for tractor operation.

A circle about two feet in diameter and six inches deep should be spaded and mixed with about an equal volume of loose moist peat. When the plants arrive, they should be set as soon as possible into the prepared positions with the uppermost roots only one or two inches below the soil surface. If immediate planting is impossible, the parcel should be opened and the plants heeled in in a shallow trench in a shady place with moist soil packed around the roots to keep the plants from drying out until they can be planted. The soil should be lightly packed around the roots and covered with sawdust to a depth of at least three inches. All fruit buds should be removed from the plant as fruiting reduces plant growth the first year. Short twigs and any dead wood should be pruned off.

The soil around the plant should be frequently checked for moisture the first few months and irrigated if necessary to keep the soil wet to the surface and partly into the sawdust or other mulch material.

The early commercial plantings were spaced about eight feet between rows and four feet between plants in the row. The greater vigor of the newer varieties, the use of larger machines for tillage, and the possibility that spraying may eventually be necessary suggest that the spacing be somewhat greater.

In small plantings, wet peat moss mixed with an equal amount of soil may be used to fill in the hole at planting time. This will be most useful on dry soils that may be low in organic matter. No fertilizer should be applied at planting.

On soils that are inclined to be too wet, the plants may be set on the back furrow or low mounds. By working the soil towards the plants and maintaining a low ridge, blueberries may be grown on land that floods occasionally during the growing season and that might otherwise be too wet for them.

Fertilizing

Usually, nitrogen is the principal fertilizer element that blueberries need every year. For most effective utilization, this should be in the ammonium form. Blueberries absorb and utilize the ammonium form of nitrogen more readily than the nitrate form, and thus such fertilizer materials as ammonium sulfate, ammonium nitrate, and ammonium phosphate should be used.

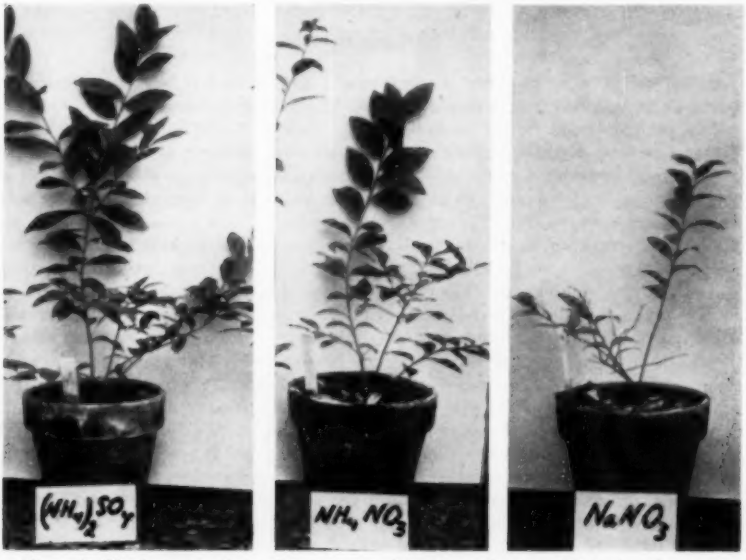

Figure 3. Blueberry cuttings after one growing season during which the plants were fed: *(left)* ammonium sulfate, *(center)* ammonium nitrate, and *(right)* nitrate of soda. The soil was not acid enough for normal blueberry culture, but those plants that received ammonium sulfate were vigorous and healthy whereas those that received nitrate of soda made poor growth and the foliage was very yellow.

The use of ammonium nitrogen as a fertilizer material is of special importance if the soil is near pH 5.0 or above, the upper range of pH tolerance, because in this pH range nitrifying bacteria become increasingly active and soon convert all available nitrogen in the soil to the nitrate form. In more acid soils that are well supplied with organic matter, another group of organisms become active and convert nitrate to ammonium. Under these latter soil conditions, nitrate fertilizer material may be used satisfactorily.

The requirement of blueberry plants for other nutrients, such as potash, phosphorus, calcium, magnesium, and the like, is rather low compared with that of other fruit plants. Usually there are adequate quantities of these minerals present in the soil. In very acid sandy soils, some of these nutrients may be lacking and a complete fertilizer would prove beneficial. A complete fertilizer program is normally followed in the sandy coastal plain areas for this reason. On some very acid soils, below pH 4.0, lime has proved beneficial, but these areas are not frequently found in New York.

Iron-deficiency symptoms, indicated by yellowing or mottling of the young leaves, usually results when there is a lack of soil acidity and may be associated with the form of both nitrogen and iron available to the plant. It may be temporarily corrected by foliage sprays with soluble iron salts or the incorporation of certain iron salts in the soil. If, however, the soil is not acid enough, these applications are soon converted into non-functional forms and the chlorosis appears again on the new growth. Materials containing chelated iron are on the market that provide functional iron in the soil over a longer period than does ordinary ferrous sulfate and they have been beneficial on soils up to pH 6.0 to 6.5 when used with plenty of organic matter in the soil.

Figure 4. New vigorous shoots arise from old canes as a result of extra nitrogen fertilizer. The old cane should be cut back to these new shoots in the spring. At upper left (arrow) is an old cane headed back the previous spring.

The plants should not be fertilized when set but may be given from two to four ounces of ammonium sulfate in June. Thereafter they should receive about one-fourth pound of ammonium sulfate, or its equivalent of other ammonium nitrogen carrier, each spring when the buds begin to swell and a second application about six weeks later. The rate should be increased as the plants grow larger to about one-half pound per application for mature plants bearing from three to four quarts of berries. The fertilizer should be spread evenly about the plant over an area approximately equal to that of the top of the bush.

Pruning

A blueberry bush left unpruned even under the most ideal soil conditions will usually overbear, produce small fruit, and make little or no strong new wood for the next year's crop. In two or three years such a bush is a mass of short thin shoots incapable of producing marketable fruit.

The blueberry is somewhat like the peach in its fruiting habit, producing a large number of fruit buds on the new terminal shoot growth. If all of these fruit buds, each of which produces a cluster of five to eight berries, is permitted to remain on the plant, over production and small worthless fruit result. Also, short thin shoot growth is produced, resulting in poor fruiting wood for the following year's crop. Strong vigorous shoots invariably produce the best berries.

Thus when pruning, a twofold purpose must be kept in mind: (1) to adjust the fruit crop to the capacity of the bush and root system, and (2) to stimulate strong vigorous shoots for next year's crop. The capacity of the root system to supply water and nutrients to the top of the plant is divided between the fruit crop and the vegetative growth of the bush, with the fruit crop getting first choice. Thus, if the bush is overloaded with fruit, there will be little food left to produce vegetative growth and the bush will become weak and twiggy and the fruit will be small.

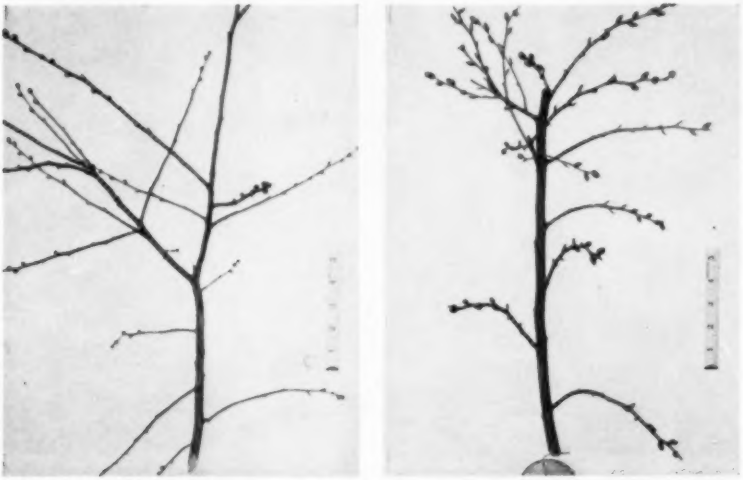

Figure 5. Left: This vigorous well-branched cane needs no pruning. *Right:* Heading back a vigorous sucker cane forces many strong lateral branches that will bear large fruit.

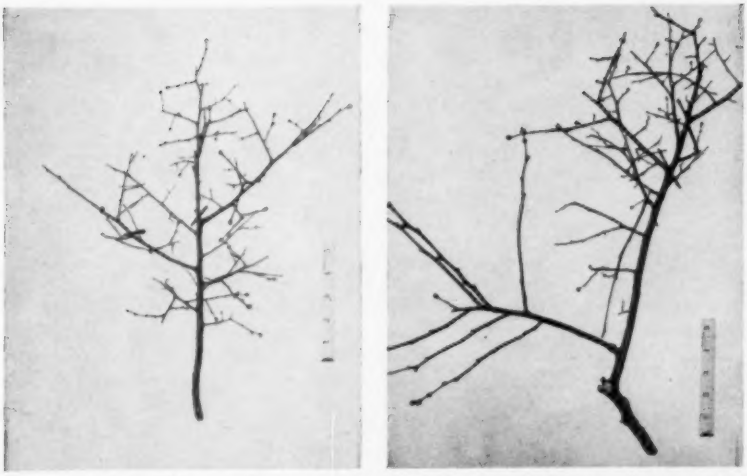

Figure 6. Left: This cane bore too many fruits last year and has made poor shoot growth. It should be headed back to the strong lateral, and some of the smaller twigs should be removed. *Right:* A strong vigorous shoot has grown near last year's pruning cut. About one-half of the twiggy branch to the right should be removed this year at pruning time.

At pruning time in late March or early April, the fruit buds can be identified by their large size and thus the potential crop estimated. The less vigorous twiggy canes should be headed back to a strong lateral branch or a new shoot, and most of the short twigs with fruit buds removed. Strong vigorous canes can usually be pruned to remove about 50 per cent of the fruit buds by taking off the weaker new growth. A good rule of thumb is to leave one fruit bud for each three inches of new shoot growth.

Old woody canes should not be cut to the ground unless diseased or injured, as these are the basis of increasing the overall size of the bush. If weak growth is evident, the canes can usually be headed back to a lower lateral branch as new strong shoots will originate near the pruning cut. An average mature bush should have six or eight vigorous healthy canes, the weaker ones and suckers being removed at the ground level each year.

Pruning should be completed before the bushes come into bloom. A general guide to pruning is as follows:

1. Limit the number of canes or main branches arising near the crown to one for each year of age of the plant or for each foot of height of the bush, or a maximum of six to eight canes for old bushes.
2. Remove sucker shoots and all weak twiggy branches.
3. Thin vigorous fruiting wood to approximately one fruit bud per 3 inches of shoot growth.

Generally shoots less than three inches long make poor fruiting wood. It should be remembered in estimating the crop that each fruit bud produces from five to eight berries.

As the bushes grow older and have a more extensive root system, new vigorous canes arise from the crown that exceed the height of the bush. These may be used as additional or replacement canes. They should be headed back to about the average height of the bush to induce strong lateral branches. These laterals usually fruit the following year. After three or four years many of the low-spreading branches can be removed as they are replaced by taller more vigorous ones thus increasing the height and spread of the bush and getting the fruiting wood in a more convenient position for harvesting.

Pest Control

In small plantings, birds are usually the worst pests. No entirely satisfactory method has yet been found to keep birds away from blueberries.

Netting and wire may be placed over the bushes, and there are various devices to use to frighten birds. Probably one of the most effective is the stuffed owl or fox that is moved from day to day during the ripening period. Larger plantings seem to suffer very little from birds, probably because the birds have their fill with plenty left over for the grower.

There are a number of insects and diseases of blueberries but these usually become of economic importance only in large plantings. Growers are advised to follow insect control recommendations of local county agents when the need arises.

Harvesting

Most varieties ripen over a two- or three-week period necessitating several pickings. The berries should be fully colored and easily removed from the cluster before harvesting. The berries usually turn blue two or three days before they develop the maximum sweetness and flavor. The best guide as to when to harvest is to wait until about one-third of the berries are blue. It is best to pick them by gently rolling them from the cluster with the thumb into the palm of the hand, thus the berries that are not quite ripe enough and are more firmly attached will not be picked.

The berries are best harvested directly into pint or quart berry baskets so that there is a minimum of handling afterwards, especially if they are to be marketed. Much handling rubs the "bloom" from the fruit, which gives an unattractive appearance.

A publication of the
New York State College of Agriculture,
a unit of the State University,
at Cornell University
Ithaca, New York

Revised March 1960

Cooperative Extension Service, New York State College of Agriculture at Cornell University and the U. S. Department of Agriculture cooperating. In furtherance of Acts of Congress May 8, June 30, 1914. M. C. Bond, Director of Extension, Ithaca, New York.